Study of women representation in the field of relativistic heavy-ion collisions

Natasha Sharma, IISER Berhampur, Odisha.

Christine Nattrass, University of Tennessee, TN, USA

8th IUPAP International Conference on Women in Physics (ICWIP2023)

Abstract: It is observed that the females are underrepresented in the physics major graduate course. The 2010 Global Survey of Physicists found that men are more likely to be invited speakers at conference [1]. In 2019, women made up only 22.4% of the work-force in nuclear science [2]. Recently, scholars have begun investigating gender representation in several subdisciplines of physics, such as plasma physics, particle physics etc. In this work, we turn our gaze to women in the field of relativistic heavy-ion collisions, a subfield of nuclear physics.

We will present a study of the demographics of major conferences in heavy ion physics. We look at the distribution of talks by gender between 2011–2022 in some of the most prestigious international conferences of the field such as Quark Matter, Strangeness in Quark Matter, Initial Stages, Hard Probes etc.. We find that women are often underrepresented among plenary speakers and usually underrepresented among parallel speakers. At Quark Matter, women are more likely to be given a poster presentation in lieu of an oral presentation. We will discuss the collection of data and possible approaches to make the field more equitable and, therefore, more scientifically productive.

We have investigated the representation of women in the heavy-ion community.

Introduction

Experimental High Energy Heavy-Ion Physics Community

A single experiment does not cover all of the experimentalists in the field, but all of these experiments taken together provide a good representation of all experimentalists.

- Most experimentalists primarily work on 1 or 2 major experiments:
  - Major experiments at RHIC are PHENIX, sPHENIX, and STAR
  - Major experiments at LHC are ALICE, ATLAS, CMS, and LHCb.
- Some members are part of smaller experiments such as the High Acceptance Di-Electron Spectrometer (HADES) at Gesellschaft fuer Schwerionenforschung (GSI) or work at future facilities such as the Electron Ion Collider (EIC), the Facility for Antiproton and Ion Research (FAIR), and the Nuclotron-based Ion Collider facility (NICA).

Collider	Detector	Collaborators
LHC	ALICE	1005
	CMS	$\sim 50 - 150$
	ATLAS	~ 50
	LHCb	$\lesssim 50$
RHIC	PHENIX	104
	STAR	370

TableI: Approx. no. of experimentalists in various experiments. Some experimentalists are part of multiple collaborations, we estimate 1500 unique experimentalists in the field.

Theoretical High Energy Physics Community

Gathering reliable statistics on theorists is extremely difficult. Previously, no estimates were made for the number of theorists in the field.

- Theorists typically work in small groups consisting of a single Principle Investigator (PI) and their students and postdoctoral researchers, in more recent years small topical collaborations consisting of 10 - 30 PI's have begun to appear such as the BEST, JETSCAPE, MUSES, BAND, MADAI, XTREME collaborations etc.

Women in Major Conferences

Tab. II shows the fraction of women in the major experiments in heavy ion physics.

→ These percentages indicate that the women is underrepresented in the field.

Tab. III shows the data from the ALICE collaboration on the fraction of women by career status.

→ The fraction of women clearly declines with increasing seniority, as expected.

→ The decline from PhD students to postdoctoral researchers is somewhat surprising but may be partially explained by the geographical concentration of postdoctoral researchers in Europe and the United States.

Collider	Detector	Women (%)
LHC	ALICE	23%
	ATLAS	$\sim$ 30%
RHIC	PHENIX	21%
	STAR	15% (7% undeclared)

Table II: Fraction of women in major heavy-ion Physics experiments.

PhD Student	31.3%
Post doc	23.2%
Physicist	17.9%
Senior Engineer	12.7%

Table III: Fraction of women in ALICE by career status.

Graduate students are more evenly distributed across institutions. The decline may therefore be caused by varying fractions of women in physics in different countries.

Women in Major Conferences

Abbreviation	Name	In-Person Participants	Online Participants	Parallels	Plenaries
QM	Quark Matter	810	n/a	212	38
HP	Hard Probes	273	721	173	34
SQM	Strangeness in Quark Matter	245	634	125	44
IS	Initial Stages	130	488	99	41

Table IV: Major conferences, their abbreviations, average number of in-person participants from 2013 to 2019, average no. online participants from 2020 to present, average no. of parallels and plenaries per conference series are shown.

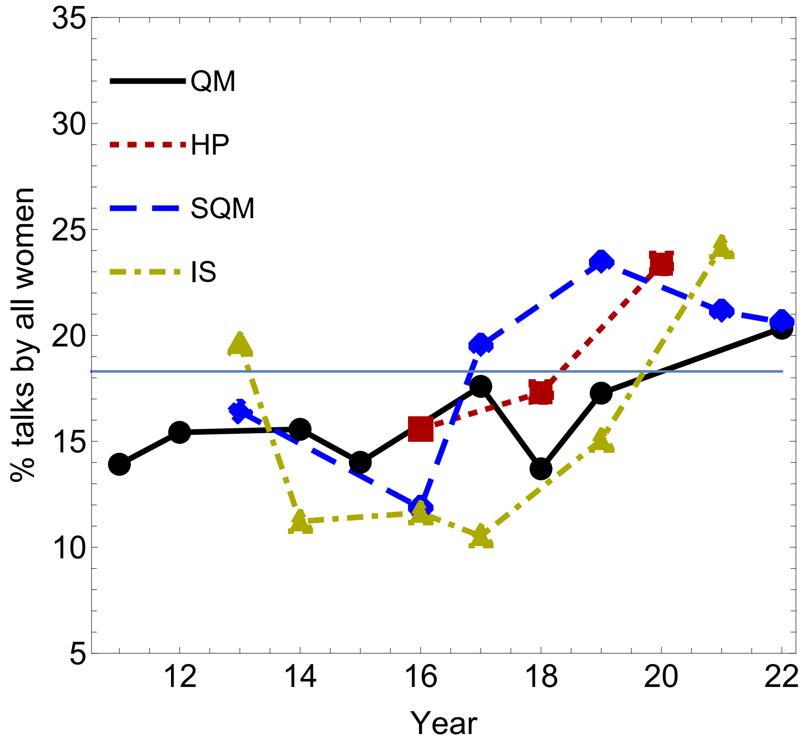

Table V: Percentage of parallels plus plenaries give by women sorted by different conferences.

Women in Major Conferences

Discussions:

- It is particularly important that talk allocation gives all scholars a fair chance to present their work.
- There are other inequities in talk distribution like race, ethnicity, participant's geographical location etc.
  → This inhibits the fair consideration of the ideas developed by these scientists and impedes progress in the field.

- In most cases, conference organizers do not openly harbor attitudes against women or their work and do not consciously aim to underrepresent women among speakers.
- Indeed, many organizing committees make a concerted effort to find female speakers.
- The underrepresentation of women among speakers may arise partly because
  - women may be less likely to receive adequate support or mentorship from their supervisors, and, consistent with extensive social science research indicating that women are less confident [4, 5],
  - women may be less likely to submit abstracts for high profile conferences.

Suggestions:

A standing body to oversee major conferences could lead to significant improvements in these conferences. Such a body could oversee developing more consistent and clear policies such as:

1. Double blind review for first round of abstract review
2. Use a rubric for evaluation of abstracts
3. Use a multi-stage process for determining candidate plenary speakers for major conferences
4. Increase the number of talks and posters

The size of the field has increased significantly, and that may mean that these conferences should grow as well.
We hope that at least some of these ideas will be considered, but at the very least, we hope that this will begin a robust discussion in the field about who deserves a chance to be heard.

References:

[1] American Institute of Physics (2019), found here https://www.aip.org/statistics/reports/women-physics-and-astronomy-2019

[2] “Toward closing the gender gap in nuclear science,” (2019), found here https://www.iaea.org/newscenter/news/toward-closing-the-gender-gap-in-nuclear-science

[3] C. L. Exley and J. B. Kessler, The Gender Gap in Self-Promotion, Working Paper 26345, National Bureau of Economic Research (2019), 10.3386/w26345, URL http://www.nber.org/papers/w26345

[4] M. J. Liberatore and W. P. Wagner, Gender, Performance, and Self-Efficacy: A Quasi-Experimental Field Study, Journal of Computer Information Systems 62 (2022) 109, 10.1080/08874417.2020.1717397